

FIRE AND SECURITY

**AUTRO
SAFE**
Self Verify®



AutroFlame X33AF PL Multispectrum IR Flame Detector

Installation Handbook

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1. Introduction

1.1 About the Handbook

This handbook is intended to provide all necessary information for the installation of the AutoFlame X33AF PL Flame Detector.

1.2 The Reader

The handbook is intended for Autronica Fire and Security trained service and technical personnel who are responsible for the installation of the AutoFlame X33AF PL.

1.3 Other Reference Documents

For further information on the AutoFlame X33AF PL flame detector, refer to the datasheet with the following part number:

- 116-P-X33AF/PL/CE

2. Description

IMPORTANT

Be sure to read and understand the entire instruction manual before installing or operating the flame detection system.

The AutoFlame Multispectrum Flame Detector X33AF PL utilises advanced signal processing algorithms, supported by an embedded 32-bit microprocessor, to provide continuous protection in the presence of false alarm sources and environments with infrared radiation present.

The detector has built-in PowerLoop technology which makes the detector capable of being powered and communicating with AutoSafe Integrated Fire and Gas panels (IFG) on the same pair of wire, saving cable cost and weight. Each detector has a built-in short circuit isolator; hence no detectors will be lost because of a single break or short circuit in the PowerLoop lines.

All alarms and faults will be signalled via PowerLoop.

The PowerLoop is a two-wire power and signalling bus connected in ring topology and is galvanically isolated from the rest of the system.

The detector does not require any local power supply.

The detector has a detection range to gasoline of over 60m, and a solid cone of vision for methane.

The X33AF PL includes the Automatic Optical Integrity (oi) feature - a calibrated performance test that is automatically performed once per minute to verify complete detector operation capabilities. No testing with an external test lamp is required.

The X33AF PL is a multispectrum infrared (IR) flame detector. It provides unsurpassed detection of fires from light to heavy hydrocarbon fuels combined with the highest degree of false alarm rejection. The detector has explosion-proof ratings and is suitable for use in indoor and outdoor applications.

The X33AF PL contains three IR sensors with their associated signal processing circuitry. A multi-colour LED on the detector faceplate indicates detector status condition. Microprocessor controlled heated optics increase resistance to moisture and ice.

The X33AF PL housing is available in aluminium or stainless steel, with NEMA 4X and IP66 rating.

2.1 LED

A tricolor LED on the detector faceplate indicates normal, fire alarm and fault conditions. Table 2 indicates the condition of the LED for each detector status.

Detector Status	LED indicator
Power On/Normal Operation (No fault or fire alarm)	Green
Fault	Amber
Fire (Alarm)	Red
Medium Sensitivity	Two Amber Flashes During Power-up
Very High Sensitivity	Four Amber Flashes During Power-up

2.2 Optical Integrity (Oi)

2.2.1 Automatic Oi

The X33AF PL includes the Automatic Optical Integrity (oi) feature - a calibrated performance test that is automatically performed once per minute to verify complete detector operation capabilities. No testing with an external test lamp is required. The detector automatically performs the same test that a maintenance person with a test lamp would perform - once every minute, 60 times per hour. A successful automatic of test does not produce an alarm condition.

The X33AF PL signals a fault condition when less than 50% of the detection range remains. This is indicated by the yellow colour of the LED on the face of the detector. See the "Troubleshooting" section for further information.

2.2.2 Magnetic Oi

The detector also incorporates a magnetic oi feature that provides the same calibrated test as the automatic oi, and in addition actuates an alarm to verify output operation for preventive maintenance requirements. This feature can be performed at any time and eliminates the need for testing with an external test lamp.

CAUTION: These tests require disabling of all extinguishing devices to avoid release resulting from a successful test.

Perform the magnetic oi test by placing a magnet by the marked location (mag oi) on the outside of the detector. This test activates the calibrated IR emitters. If the resulting signals meet the test criteria, indicating that greater than half of the detection range remains, an alarm message is sent to the panel and the indicating LED changes to red. This condition remains until the magnet is removed.

If less than half of the detection range remains, no alarm is produced and a fault is generated.

The AutoSafe IFG panel has to be reset after the test is completed.

2.3 Automatic Alarm Test

The X33AF PL performs an automatic alarm-path test every 24 hours. This test includes the functionalities of the magnetic oi test, and is also making sure that the alarm is transmitted to the panel. If this test is successful, no indication will be given on the panel. However, if the test fails, a fault message is generated on the AutoSafe IFG panel.

2.4 Communication

The X33AF PL has built-in PowerLoop technology which makes the detector capable of being powered by and communicating with AutoSafe Integrated Fire and Gas panels (IFG) on the same pair of wire, saving cable cost and weight.

2.5 Data Logging

Data logging capability is also provided. Status conditions such as normal, power down, general and oi faults, pre-alarm, fire alarm, time and temperature are recorded. Each event is time and date stamped, along with the temperature and input voltage. Event data is stored in non-volatile memory when the event becomes active, and again when the status changes. Data from the log can only be extracted at the factory.

2.6 Integral Wiring Compartment

All external wiring to the device is connected within the integral junction box. The screw terminals accept wiring from 14 to 24 AWG (2.0 – 0.2 mm²). The detector is furnished with four conduit entries, with 25 mm threads.

3. General Application Information

3.1 Response Characteristics

Response is dependent on distance, type of fuel, temperature of the fuel, and time required for the fire to come to equilibrium. As with all fire tests, results must be interpreted according to an individual application.

See Appendix A for fire test results.

3.2 Important Application Considerations

In applying any type of sensing device as a fire detector, it is important to know of any conditions that can prevent the device from responding to fire, and also to know what other sources besides fire can cause the device to respond.

3.2.1 Welding

Arc welding should not be performed within 40 feet (12m) of the very high sensitivity detector (10 feet (3m) for medium sensitivity detector). It is recommended that the system be bypassed during welding operations in situations where the possibility of a false alarm cannot be tolerated. Gas welding mandates system bypass, since the gas torch is an actual fire. Arc welding rods can contain organic binder materials in the flux that burn during the welding operation and are detectable by the X33AF PL. Welding rods with clay binders do not burn and will not be detected by the X33AF PL. However, system bypass is always recommended, since the material being welded may be contaminated with organic substances (paint, oil, etc.) that will burn and possibly trigger the X33AF PL.

3.2.2 Artificial Lighting

The X33AF PL should not be located within 3 feet (1m) of artificial lights. Excess heating of the detector could occur due to heat radiating from the lights.

3.2.3 EMI/RFI Interference

The X33AF PL is resistant to interference by EMI and RFI, and is EMC Directive compliant. It will not respond to a 5-watt walkie-talkie at distances greater than 1 foot (0.3m). Do not operate a walkie-talkie within 1 foot (0.3m) of the X33AF PL.

3.2.3.1 Non-Carbon Fires

The X33AF PL is a multiple spectrum IR device with detection limited to carbonaceous fuels. It should not be used to detect fires from fuels that do not contain carbon, such as hydrogen, sulphur and burning metals.

4. Important Safety Notes

Do not open the detector assembly in a hazardous area when power is applied. The detector contains limited serviceable components and should never be opened. Doing so could disturb critical optical alignment and calibration parameters, possibly causing serious damage. This type of damage could be undetected and could result in failure to see a fire and/or false alarm.

The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with the NEC as well as all local ordinances. If in doubt, consult the authority having jurisdiction before wiring the system. The PowerLoop calculator must verify all wiring calculations. A properly trained person must do the installation.

To prevent unwanted actuation or alarm, extinguishing devices must be disabled prior to performing detection system tests or maintenance.

Remove the protective cap from the front of the detector before activating the system.

Observe precautions for handling electrostatic sensitive devices.

5. Installation

5.1 Detector Positioning

Detectors should be positioned to provide the best-unobstructed view of the area to be protected. The following factors should also be taken into consideration:

- Identify all high risk fire ignition sources
- Be sure that enough detectors are used to adequately cover the hazardous area
- Locate and position the detector so that the fire hazard(s) are within both the field of view and detection range of the device. Refer to Appendix A for specific information.
- Be sure that the unit is easily accessible for cleaning and other periodic servicing.
- The detector should be aimed downward at least 10 to 20 degrees to allow lens openings to drain. See Figure 1. **The detector should be positioned so that its field of view does not cover areas outside the hazardous area.** This will minimize the possibility of false alarms caused by activities outside the area requiring protection.

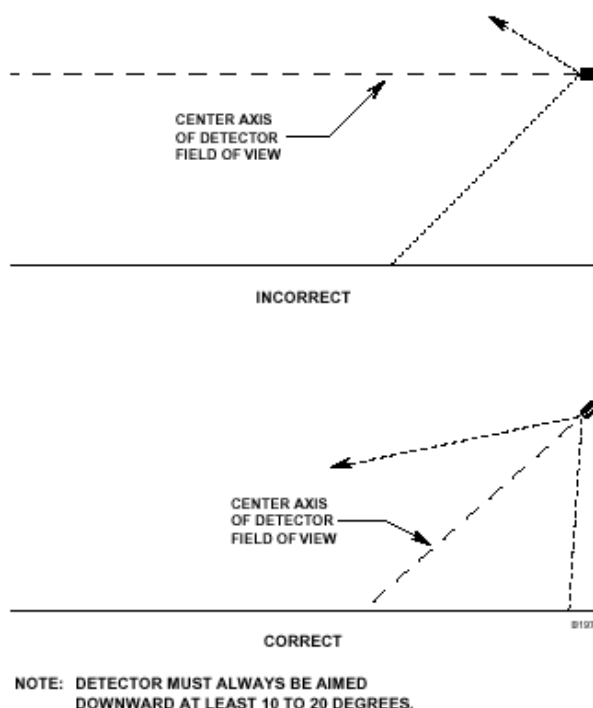


Figure 1—Detector Orientation Relative to Horizon

- For best performance, the detector should be mounted on a rigid surface in a low vibration area.
- Dense fog, rain or ice can absorb IR radiation and reduce the sensitivity of the detector.
- Although IR detectors are less affected by smoke than other detectors, the X33AF PL should not be placed where rising combustion products can obscure its vision. If smoke is expected before fire, smoke or other alternative detectors should be used in conjunction with the X33AF PL. For indoor applications, if dense smoke is expected to accumulate at the onset of a fire, mount the detector on a sidewall at least a few feet (approximately 1 meter) down from the ceiling.
- If possible, fire tests should be conducted to verify correct detector positioning and coverage.

5.1.1 Detector Orientation

Refer to Figure 2 and ensure that the oi plate will be oriented as shown when the X33AF PL is mounted and sighted. This will ensure proper operation of the oi system and will also minimize the accumulation of moisture and contaminants between the oi plate and the viewing windows. The oi plate includes an arrow, which should be pointed in the up direction, indicating that the oi plate and detector are correctly oriented.

IMPORTANT: The oi plate must be securely tightened to ensure proper operation of the oi system (40 oz./inches recommended).



Figure 2 – Front View of the X33AF PL

5.2 Protection Against Moisture Damage

It is important to take proper precautions during installation to ensure that moisture will not come in contact with the electrical connections or components of the system. The integrity of the system regarding moisture protection must be maintained for proper operation and is the responsibility of the installer.

If conduit is used, drains must be installed at water collection points to automatically drain accumulated moisture. Conduit breathers should be installed at upper locations to provide ventilation and allow water vapour to escape. At least one breather should be used with each drain.

Conduit raceways should be inclined so that water will flow to low points for drainage and will not collect inside enclosures or on conduit seals. If this is not possible, install conduit drains above the seals to prevent the collection of water or install a drain loop below the detector with a conduit drain at the lowest point of the loop.

Conduit seals may be required for compliance with explosion-proof installation requirements. Units with M25 thread must use an IP66 washer to prevent water ingress.

5.3 Wiring Procedure

5.3.1 Wire Size and Type

The X33AF PL can only be used with the AutoSafe IFG system, and must be connected to the BSD-340 PowerLoop driver.

The system should be wired using a "14 to 24 gauge" (2.0 - 0.2 mm²) cable. The wire size selected should be based on the number of detectors connected, and the cable length. The PowerLoop calculator of the AutoSafe IFG configuration tool must be used to determine the cable dimension.

NOTE: Refer to the "Power Consumption" in the "Specifications" section of this manual.

The use of shielded cable is required to protect against interference caused by EMI and RFI. When using cables with shields, terminate the shields as shown in figure 4. Consult the factory if not using shielded cable.

In applications where the wiring cable is installed in conduit, the conduit should not be used for wiring to other electrical equipment.

CAUTION: qualified personnel should perform Installation of the detector and wiring only.

5.3.2 Detector Mounting

Install the swivel mounting bracket assembly on the wall. The installation surface should be free of vibration and suitable to receive ¼-inch (M6) screws with a length of at least 1 inch (25 mm), and have sufficient capacity to hold the detector and bracket weight. Refer to Figure 3 for dimensions.

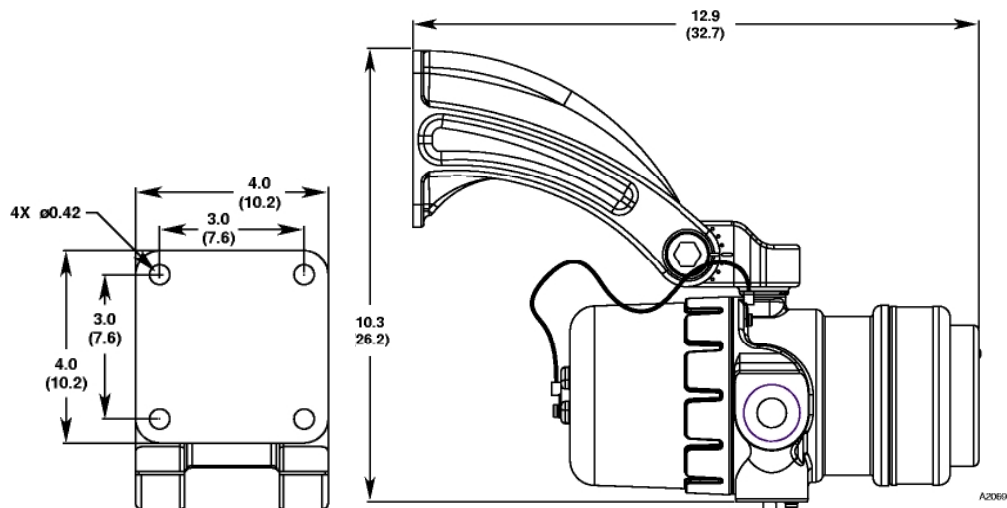


Figure 3-Q9033B Mounting Bracket dimensions in inches (cm)
(See Figure 1 for correct detector orientation.)

5.3.3 Connections

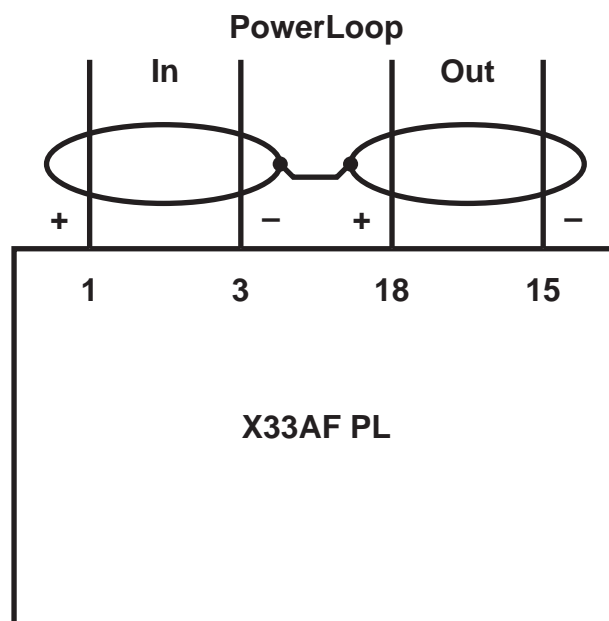


Figure 4 - If shielded cable is used for the PowerLoop, the shielding should be continued.

5.4 Start-up Procedure

When installation of the equipment is complete, perform the “Fire Alarm Test” below.

Allow 20 to 30 minutes for the detector’s heated optics to reach equilibrium.

5.4.1 Fire Alarm Test

- Disable any extinguishing equipment that is connected to the system.
- Apply input power to the system
- Initiate an oi test. (See “Magnetic oi under Optical Integrity in the Description section of this manual.)
- Repeat this test for all detectors in the system. If a unit fails the test, refer to the “Troubleshooting” section.
- Verify that all detectors in the system are properly aimed at the area to be protected. (The Q1201C Laser Aimer is recommended for this purpose.)
- Enable extinguishing equipment when the test is complete.

6. Troubleshooting

WARNING: The “front” half of the detector contains no user serviceable components and should never be opened. The terminal compartment is the only part of the enclosure that should be opened by the user in the field.

- Disable any extinguishing equipment that is connected to the unit.
- Inspect the viewing windows for contamination and clean as necessary. The detector is relatively insensitive to airborne contaminants; however, thick deposits of ice, dirt, or oil will reduce sensitivity. (Refer to the “Maintenance” section for complete information regarding cleaning of the detector viewing windows.)
- Check input power to the unit (18 – 30V DC on terminals 1, 3 and 15, 18. Ref. fig. 4)
- Check the fire panel display for fault status.
- If all wiring checks out (no wire fault warnings on the panel display) and cleaning of the oi plate/window did not correct the fault condition, check for high levels of background IR radiation by covering the detector with the factory supplied cover or aluminum foil. If the fault condition on the detector LED clears within 6 minutes or less, extreme background IR is present. Re-adjust the view of the detector away from the IR source or relocate the detector.

If none of these actions corrects the problem, return the detector to the factory for repair.

NOTE: It is highly recommended that a complete spare be kept on hand for field replacement to ensure continuous protection.

6.1 Periodic Checkout Procedure

A checkout of the system using the magnetic oi feature should be performed on a regularly scheduled basis to ensure that the system is operating properly. To test the system, perform the “Fire Alarm Test” described above.

NOTE: Automatic alarm-path testing is provided by the system once every 24 hours (This test does not activate any outputs or alarm indications on the panel).

7. Maintenance

IMPORTANT: Periodic flame path inspections are not recommended, since the product is not intended to be serviced and provides proper ingress protection to eliminate potential deterioration of the flame paths.

WARNING: The “front” half of the detector contains no user serviceable components and should never be opened. The terminal compartment is the only part of the enclosure that should be opened by the user in the field.

To maintain maximum sensitivity, the viewing windows of the X33AF PL must be kept relatively clean. Refer to the procedure below for cleaning instructions.

7.1 Cleaning Procedure

CAUTION: Disable any extinguishing equipment that is connected to the unit to prevent unwanted actuation.

To clean the windows and oi plate, use window cleaner (part number 116-001680-001) and a soft cloth, cotton swab or tissue and refer to the following procedure.

1. **Disable any extinguishing equipment that is connected to the unit.**
2. Since the X33AF PL is less affected by contamination than other detectors, removal of the oi plate is needed only under extreme conditions. In addition, it is not necessary to achieve perfect cleanliness, because slight films of oil and/or salt do not significantly absorb IR. If a fault condition is still indicated after cleaning, remove and clean the oi plate using the following procedure.
3. Clean all three viewing windows and reflector surfaces thoroughly using a clean cloth, cotton swab or tissue and Det-Tronics window cleaning solution. If a stronger solution is needed, isopropyl alcohol may be used.

7.2 Oi Plate Removal

1. Loosen the two captive screws, then grasp the oi plate by the visor and remove it from the detector. See Figure 5.
2. Thoroughly clean the oi plate reflective surfaces, holding it by its edges to avoid leaving fingerprints on the inside reflective surface.
3. Re-install the oi plate. Ensure that the plate is flat on the detector surface. Tighten the oi plate screws securely (40 oz/inches).

NOTE: If the oi plate is removed, be sure to install the original oi plate. Oi plates are not interchangeable and should not be mixed with oi plates from other detectors. If corrosive contaminants in the atmosphere cause the oi plate surface to deteriorate to the extent that it is no longer possible to restore it to its original condition, it must be replaced. Consult factory for oi plate replacement procedure.

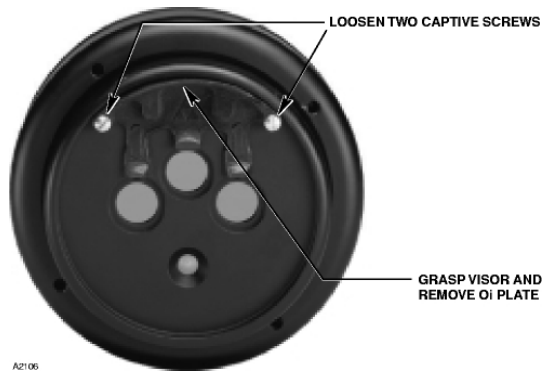


Figure 5 - oi Plate Removal

7.3 Clock Battery

The real time clock has a backup battery that will operate the clock with no external power for nominally 10 years. It is recommended that the battery be replaced every 7 years. Consult the factory for replacement procedure.

NOTE: If the backup battery is depleted, there is no effect on the operation of the flame detector, but the time stamping of the data log may be affected.

8. Features

- Long detection range to carbonaceous fires
- Unequaled false alarm rejection
- Responds to a fire in the presence of modulated blackbody radiation (i.e. heaters, ovens, turbines) without false alarm
- Microprocessor controlled heated optics for increased resistance to moisture and ice
- Magnetic optical integrity (oi) testing
- Automatic alarm-path test is performed once every 24 hours
- Easily replaceable oi plate
- Tricolor LED indicates normal operation, fire and fault
- Operates under adverse weather conditions and in dirty environments.
- Mounting swivel allows easy sighting
- Integral wiring compartment for ease of installation
- Explosion-proof/flame-proof detector housing. Meets FM, CSA and CENELEC certification requirements
- Class A wiring per NFPA-72
- Redundant PowerLoop communications and power supply
- Meets NFPA-33 response requirement for under 0.5 second (available when model selected)
- 5 year warranty
- RFI and EMC Directive Compliant

9. Specifications

9.1 Operating Voltage

The BSD-340 PowerLoop driver provides the power. The operating voltage is 20 to 30VDC.

9.2 Power Consumption

Maximum 12 watts.

9.3 Power-up Time

Fault indication clears after 0.5 second; device is ready to indicate an alarm condition after 30 seconds.

9.4 Temperature Range

Operating: -40°F to +167°F (-40°C to +75°C).
Storage: -67°F to +185°F (-55°C to +85°C).
Hazardous location ratings from -55°C to +125°C

9.5 Humidity Range

0 to 95% relative humidity, can withstand 100% condensing humidity for short periods of time.

9.6 Cone of Vision

The detector has a 90° cone of vision (horizontal) with the highest sensitivity lying along the central axis. Unlike conventional detectors, the X33AF PL provides full coverage at a minimum of 70% of the maximum detection distance.

Perfect cone of vision for methane fire detection - 100 feet on and off axis on “very high” setting.

9.7 Response Time

Typical response times are under 10 seconds. Models are available that can respond to automotive paint gunfires in under 0.5 seconds. See Appendix A for actual response times.

9.8 Enclosure Material

Copper-free aluminum (red-painted) or 316 stainless steel.

9.9 Vibration

Conformance per MIL-STD 810C (Curve AW),
DNV Note 2.4 (Class B).

9.10 Dimensions

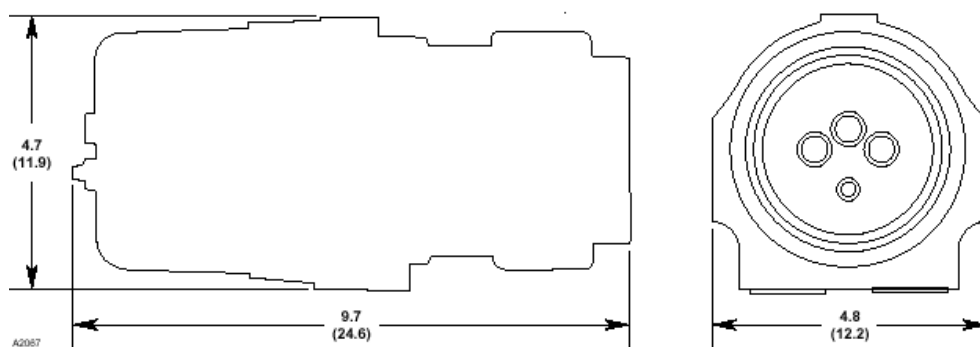


Figure 6 – X33AF PL Dimensions in inches (cm)

9.11 Wiring

14 AWG (2.0mm²) to 24 AWG (0.2mm²) shielded cable is recommended.

Important: For ambient temperatures below -10°C and above +60°C, use field wiring suitable for both minimum and maximum ambient temperature.

9.12 Thread Size

Conduit connection: M25.
Conduit seal not required.

9.13 Shipping Weight (approximate)

Aluminum: 6 pounds (2.7 kilograms).
Stainless Steel: 10 pounds (4.5 kilograms).
Swivel Mount: 14 pounds (6.4 kilograms)

9.14 Warranty Period

5 years.

9.15 Certification



Class I, Div. 1, Groups B, C and D
 Class II, Div. 1, Groups E, F, and G
 Class I, Div. 2, Groups A, B, C and D (T3C)
 Class II, Div. 2, Groups F and G (T3C); Class III
 Enclosure NEMA/Type 4X



CENELEC:
Increased Safety Model

CE: 0539 Ex II 2 GD
 EEx de IIC T5-T6
 DEMKO 01 ATEX 130204
 T6 ($T_{amb} = -55^{\circ}\text{C}$ to $+60^{\circ}\text{C}$)
 T5 ($T_{amb} = -55^{\circ}\text{C}$ to $+75^{\circ}\text{C}$)
 IP66



Flameproof Model

0539 Ex II 2 GD
 EEx d IIC T4-T6
 DEMKO 01 ATEX 130204
 T6 ($T_{amb} = -55^{\circ}\text{C}$ to $+60^{\circ}\text{C}$)
 T5 ($T_{amb} = -55^{\circ}\text{C}$ to $+75^{\circ}\text{C}$)
 T4 ($T_{amb} = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$)
 IP66

Conforms with: Low Voltage Directive (73/23/EEC)
 Electromagnetic Compatibility Directive
 (89/336/EEC)
 Explosive Atmosphere Directive (94/9/EC)
 Construction Product Directive (89/106/EEC)

VdS Performance verified per EN54-10.

NOTE: All cable entry devices and blanking elements shall be certified to "E-generation" or "ATEX" standards, in type of explosion protection increased safety "e" or flameproof enclosure "d" (as applicable), suitable for the conditions of use and correctly installed. They shall maintain the degree of ingress protection IP66 for the apparatus. Unused apertures shall be closed with suitable blanking elements.

NOTE: Operational performance verified from -40°C to $+75^{\circ}\text{C}$.

10. Replacement Parts

The detector should not be repaired in the field. If a problem should develop, refer to the Troubleshooting section. If it is determined that the problem is caused by an electronic defect, the device must be returned to the factory for repair.

10.1 Device Repair and Return

Prior to returning devices, contact the nearest local Autronica Fire and Security office so that a Service Order number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure.

Pack the unit properly. Use sufficient packing material in addition to an antistatic bag or aluminium-backed cardboard as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory.

NOTE: It is highly recommended that a complete spare be kept on hand for field replacement to ensure continuous protection.

10.2 Accessories

Part Number	Description
116-5861-011.9050	Q9033B Swivel Mount Assembly is required for mounting the detector
116-007255-001	Q1201C Laser Aimer is recommended for verifying detector aiming
116-007338-001	Q2000A Weather Shield is recommended for outdoor environments

10.3 Replacement Parts

Part Number	Description
116-001680-001	Window cleaner squeeze bottle (package of six bottles)
116-005003-001	Silicone-free grease

For assistance in ordering a system to fit your application, please contact:

Autronica Fire and Security AS
N-7483 Trondheim
Norway
Phone: +47 73 58 25 00
Fax: +47 73 58 25 01
Web site: www.autronicafire.no

11. Appendix A

FACTORY MUTUAL X33AF PL PERFORMANCE REPORT

OPTICAL INTEGRITY TEST:

The detector generated an optical fault in the presence of contamination on any single or combination of lens surfaces resulting in a loss of approximately 50% of its detection range, verifying that the detector performs a calibrated Automatic optical integrity (oi) test for each sensor. Upon removal of the contamination, the detector fault was cleared and the detector was verified to detect a fire.

The Magnetic oi performs the same calibrated test as the Automatic oi, and additionally signals the alarm to the panel. If there is a 50% loss of its detection range, an alarm signal is not generated.

X33AF PL PERFORMANCE REPORT – CONTINUED**Response Characteristics:****Very High Sensitivity**

Fuel	Size	Distance (feet)	Average Response Time (seconds)
n-Heptane	1 x 1 foot	210*	11
n-Heptane**	1 x 1 foot	210*	6
n-Heptane	1 x 1 foot	100	3
n-Heptane	6 in.x 6 in.	80	3
Isopropanol	6 in.x 6 in.	70	4
Diesel**	1 x 1 foot	150*	14
Methanol	6 in. x 6 in.	40	3
Methanol	1 x 1 foot	150*	18
Methanol**	1 x 1 foot	150*	7
Methane	30 inch plume	100	3
JP-5**	1 x 1 foot	150*	2
JP-5**	2 x 2 foot	210*	4
JP-5**	2 x 2 foot	100	2
Office Paper 0.5 lb.	19" x 19" x 8"	100	4
Corrugated Panel	18" x 36"	100	8

* Outdoors test condition

** Pre-burn from ignition

Medium Sensitivity

Fuel	Size	Distance (feet)	Average Response Time (seconds)
n-Heptane	1 x 1 foot	100	12
n-Heptane	1 x 1 foot	50	2
Diesel**	1 x 1 foot	70	4
Methanol	1 x 1 foot	70	10
Methane	30 inch plume	65	3
Methane	30 inch plume	55	2
JP-5**	2 x 2 foot	100	3
Office Paper 0.5 lb.	19" x 19" x 8"	50	6
Corrugated Panel	18" x 36"	50	2

** Pre-burn from ignition

X33AF PL PERFORMANCE REPORT – CONTINUED

Response characteristics in the presence of false alarm sources:

Very High Sensitivity

False Alarm Source	Distance (feet)	Fire Source	Distance (feet)	Average Response Time (seconds)
Sunlight, direct, modulated, reflected	-	6-inch propane	6	<10
Vibration	N/A	3-inch propane	10,5	<10
Radio frequency interference	1	3-inch propane	12	<10
Arc welding, #7014	40	1 x 1 foot n-Heptane	40	4
6 kw heater, modulated	80	1 x 1 foot n-Heptane	80	1
6 kw heater, unmodulated	10	1 x 1 foot n-Heptane	80	2
250 w vapor lamp, modulated	3	1 x 1 foot n-Heptane	80	2
300 w incandescent lamp, modulated	3	1 x 1 foot n-Heptane	80	7
500 w shielded quartz halogen lamp, modulated	8	1 x 1 foot n-Heptane	80	2
500 w unshielded quartz halogen lamp, modulated	8	1 x 1 foot n-Heptane	80	3
1500 w electric radiant heater, modulated	10	1 x 1 foot n-Heptane	80	5
Two 34 w fluorescent lamps, modulated	3	1 x 1 foot n-Heptane	80	2,5

Medium Sensitivity

False Alarm Source	Distance (feet)	Fire Source	Distance (feet)	Average Response Time (seconds)
Sunlight, direct, modulated, reflected	-	6-inch propane	6	<4
Vibration*	N/A	N/A	N/A	N/A
Radio frequency interference	1	6-inch propane	6	<10
Arc welding, #7014	10	1 x 1 foot n-Heptane	40	4
6 kw heater, modulated	60	1 x 1 foot n-Heptane	60	2
6 kw heater, unmodulated	10	1 x 1 foot n-Heptane	60	2
250 w vapor lamp, modulated	3	1 x 1 foot n-Heptane	60	1
300 w incandescent lamp, modulated	3	1 x 1 foot n-Heptane	60	1
500 w shielded quartz halogen lamp, modulated	8	1 x 1 foot n-Heptane	60	1
500 w unshielded quartz halogen lamp, modulated	8	1 x 1 foot n-Heptane	60	1
1500 w electric radiant heater, modulated	10	1 x 1 foot n-Heptane	60	6
Two 34 w fluorescent lamps, modulated	3	1 x 1 foot n-Heptane	60	2

* Fire was verified with very high sensitivity only

X33AF PL PERFORMANCE REPORT – CONTINUED

False Alarm Immunity:

Very high sensitivity

False Alarm Source	Distance (feet)	Modulated Response	Unmodulated Response
Sunlight, direct, reflected	-	No alarm	No alarm
Vibration	N/A	No alarm	N/A
Radio frequency interference	1	No alarm (keyed)	No alarm (steady)
Arc welding	40	No alarm	No alarm
6 kw heater	3	No alarm	No alarm
250 w vapor lamp	3	No alarm	No alarm
300 w incandescent lamp	3	No alarm	No alarm
500 w unshielded quartz halogen lamp	8	No alarm	No alarm
500 w shielded quartz halogen lamp	8	No alarm	No alarm
1500 w electric radiant heater	3	No alarm	No alarm
Two 34 w fluorescent lamps	3	No alarm	No alarm

Medium sensitivity

False Alarm Source	Distance (feet)	Modulated Response	Unmodulated Response
Sunlight, direct, reflected	-	No alarm	No alarm
Vibration	N/A	No alarm	N/A
Radio frequency interference	1	No alarm (keyed)	No alarm (steady)
Arc welding	10	No alarm	No alarm
6 kw heater	3	No alarm	No alarm
250 w vapor lamp	3	No alarm	No alarm
300 w incandescent lamp	3	No alarm	No alarm
500 w unshielded quartz halogen lamp	8	No alarm	No alarm
500 w shielded quartz halogen lamp	3	No alarm	No alarm
1500 w electric radiant heater	3	No alarm	No alarm
Two 34 w fluorescent lamps	3	No alarm	No alarm

X33AF PL PERFORMANCE REPORT – CONTINUED

Field of view

Very high sensitivity

Fuel	Size	Distance (feet)	Horizontal (degrees)	Avg. Horiz. Response Time (seconds)	Vertical (degrees)	Avg. Vert. Response Time (seconds)
n-Heptane	1x1 foot	150*	+45 -45	12 14	+45 -30	13 5
n-Heptane	1x1 foot	100	+45 -45	6 3	+45 -30	3 2
n-Heptane	6 in. x 6 in.	80	+45 -45	5 6	+45 -30	4 4
Isopropanol	6 in. x 6 in.	70	+45 -45	5 5	+45 -30	4 6
Diesel**	1x1 foot	100	+45 -45	2 3	+45 -30	4 3
Methanol	6 in. x 6 in.	40	+45 -45	4 6	+45 -30	3 3
Methanol	1x1 foot	110	+45 -45	9 7	+45 -30	9 3
Methane	30 inch plume	100	+45 -45	7 3	+45 -30	2 2
JP-5**	1x1 foot	100	+45 -45	2 4	+45 -30	3 2
JP-5**	2x2 feet	180*	+45 -45	2 5	+45 -30	3 2
JP-5**	2x2 feet	90	+45 -45	2 3	+45 -30	1 2
Office paper 0,5 lb	19"x19"x8"	80	+45 -45	4 2	+45 -30	2 1
Corrugated paper	18"x36"	80	+45 -45	1 1	+45 -30	3 2

* Outdoors test condition

** Pre-burn from ignition

X33AF PL PERFORMANCE REPORT – CONTINUED

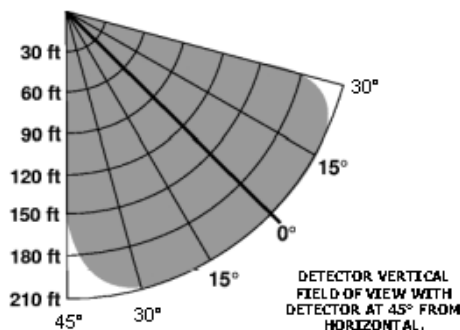
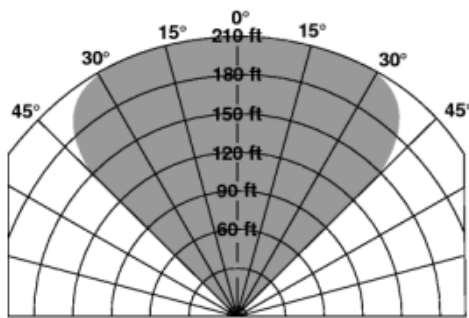
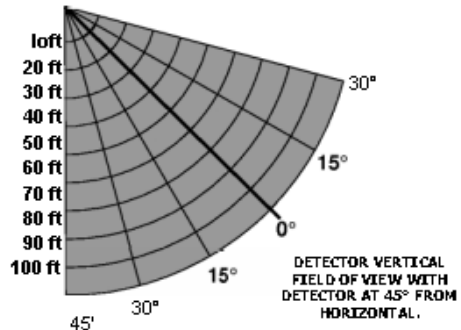
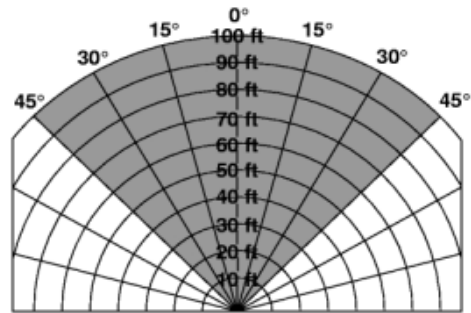
Medium sensitivity

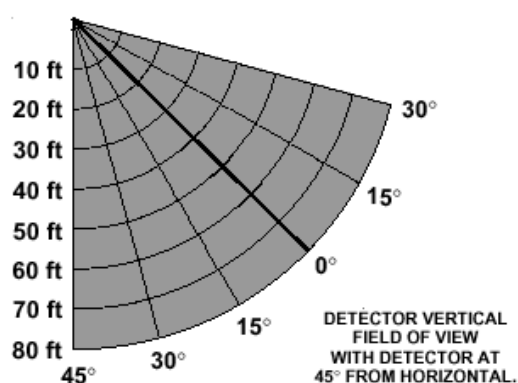
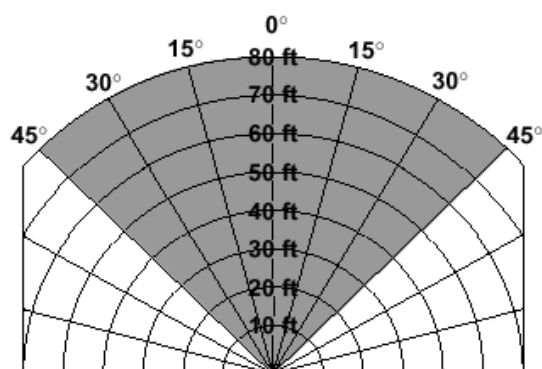
Fuel	Size	Distance (feet)	Horizontal (degrees)	Avg. Horiz. Response Time (seconds)	Vertical (degrees)	Avg. Vert. Response Time (seconds)
n-Heptane	1x1 foot	75	+45 -45	9 6	+45 -30	10 7
n-Heptane	1x1 foot	50	+45 -45	4 3	+45 -30	3 3
Diesel**	1x1 foot	60	+45 -45	4 4	+45 -30	4 2
Methanol	1x1 foot	50	+45 -45	9 3	+45 -30	9 1
Methane	30 inch plume	45	+45 -45	3 3	+45 -30	7 1
JP-5**	2x2 feet	90	+45 -45	4 2	+45 -30	2 2
Office paper 0,5 lb	19"x19"x8"	40	+45 -45	2 1	+45 -30	1 1
Corrugated paper	18"x36"	40	+45 -45	2 1	+45 -30	1 1

* Outdoors test condition

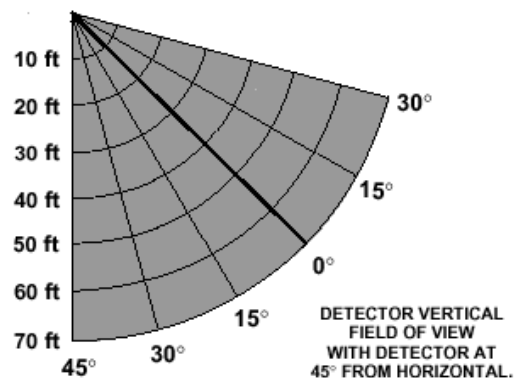
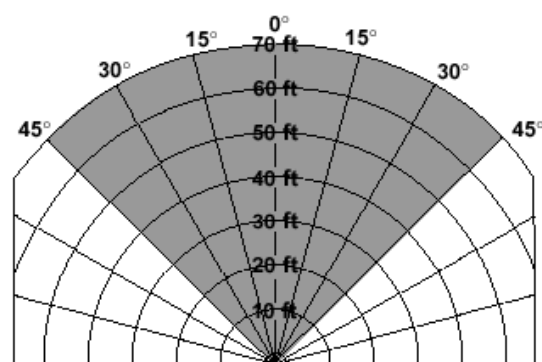
** Pre-burn from ignition

HIGH RESOLUTION FIELD OF VIEW

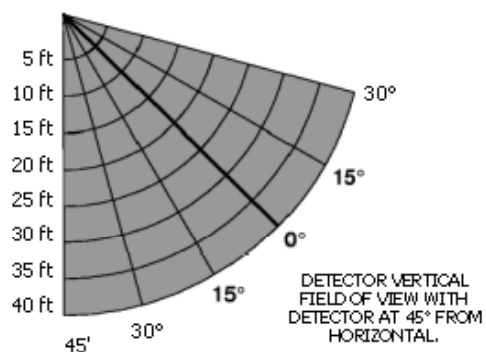
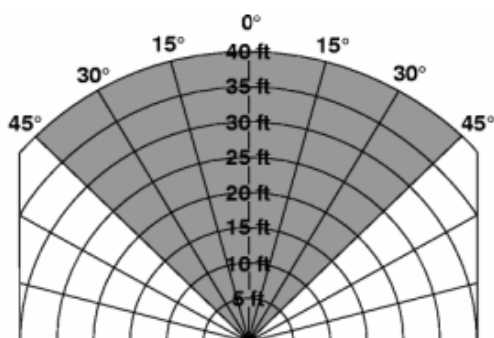
Field of view at indicated distance in feet for **n-Heptane** at **very high** sensitivity (1 x 1 foot)Field of view at indicated distance in feet for **methane** at **very high** sensitivity (30 inch plume)



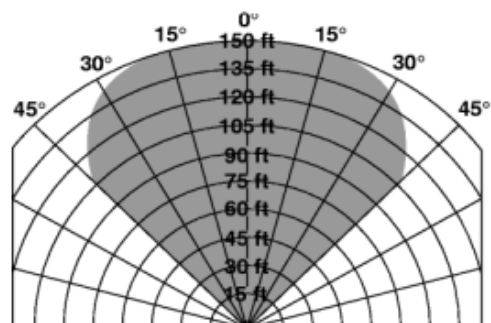
Field of view at indicated distance in feet for **n-Heptane** at **very high** sensitivity (6 in.x 6 in.)



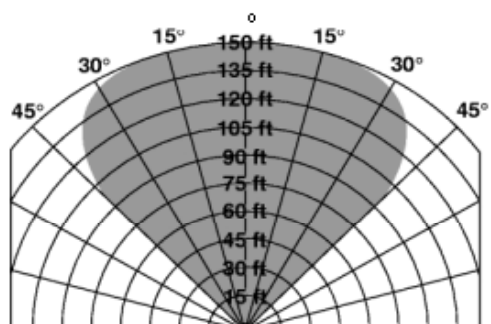
Field of view at indicated distance in feet for **Isopropanol** at **very high** sensitivity (6 in.x 6 in.)



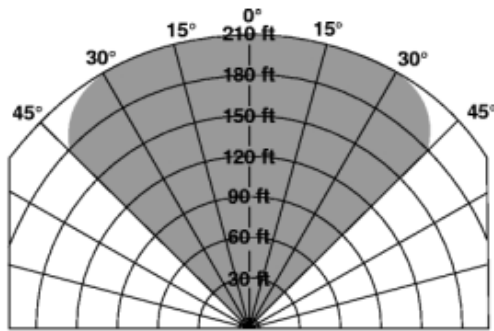
Field of view at indicated distance in feet for **Methanol** at **very high** sensitivity (6 in.x 6 in.)



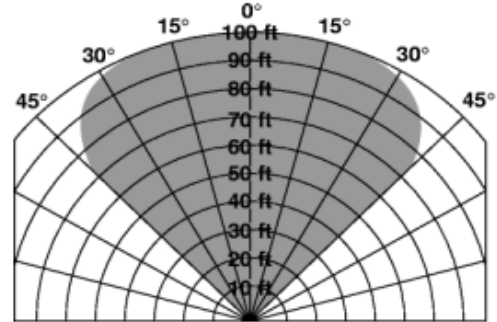
Field of view at indicated distance in feet for **Methanol** at **very high** sensitivity (1x1 foot)



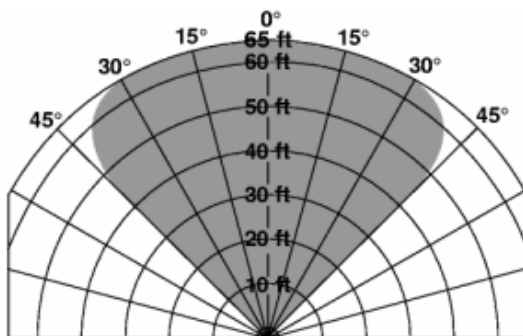
Field of view at indicated distance in feet for **Diesel** at **very high** sensitivity (1x1 foot)



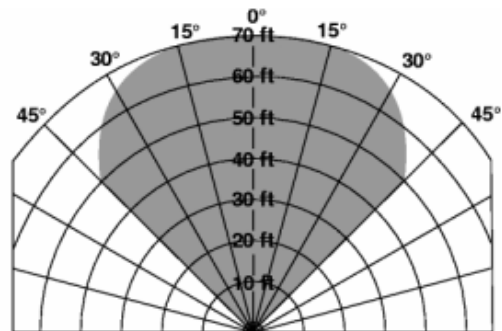
Field of view at indicated distance in feet for **JP-5** at **very high** sensitivity (2x2 feet)



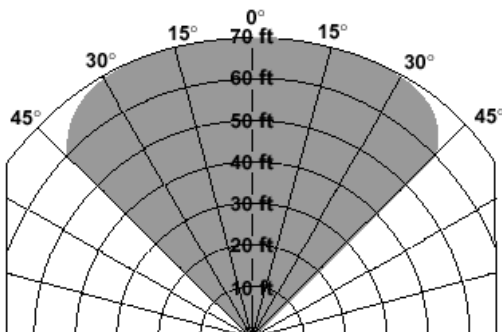
Field of view at indicated distance in feet for **n-Heptane** at **medium** sensitivity (1x1 foot)



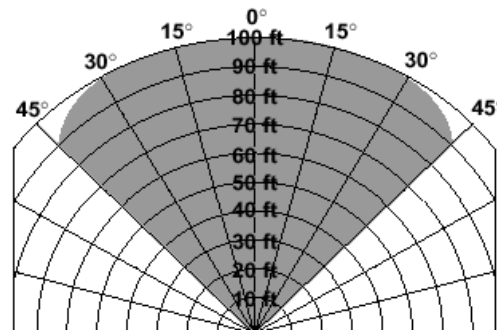
Field of view at indicated distance in feet for **Methane** at **medium** sensitivity (30 inch plume)



Field of view at indicated distance in feet for **Methanol** at **medium** sensitivity (1x1 foot)



Field of view at indicated distance in feet for **Diesel** at **medium** sensitivity (1x1 foot)



Field of view at indicated distance in feet for **JP-5** at **medium** sensitivity (2x2 feet)

NOTE

Factory Mutual Research minimum requirements are response distance measurements at 0° (on axis) and the limits of the field of view. These high resolution field of view diagrams show the measured response distances at all the indicated angles in the horizontal plane.

12. Reader's Comments

Please help us to improve the quality of our documentation by returning your comments on this manual:

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